

Chapter 7

Routing



Episode 7.01

Episode **Introduction to Routers**
title:

Objective: **1.2 Compare and contrast networking appliances, applications, and functions.**

L3s

A router is a box that connects Network IDs

Routing table

Default Route

Upstream Router

Gateway Routers



Episode 7.02

Episode **Network Address Translation**
title: **(NAT)**

Objective: **5.5 Given a scenario, use the appropriate tool or protocol to solve networking issues**

L3s

Network Address Translation (NAT)

Static NAT (SNAT)

Dynamic NAT (DNAT)

Port Address Translation (PAT)

A faint, stylized network diagram in the top right corner, showing a cluster of nodes connected by lines, representing a network topology.

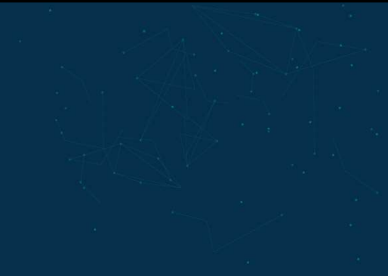
Episode 7.03

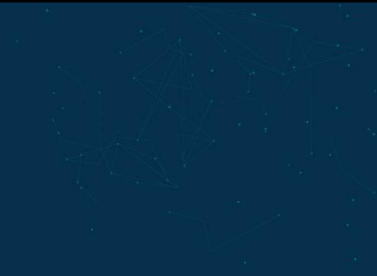
Episode **Implementing NAT**
title:

Objective: **2.1 Explain characteristics of routing technologies.**

L3s

No L3s





Episode 7.04

Episode **Forwarding Ports**
title:

Objective: **2.1 Explain characteristics of routing technologies.**

L3s

Port forwarding

Port range forwarding

Port Triggering

FTP: Port 20, 21-

SOHO DMZ



Episode 7.05

Episode **Tour of a SOHO Router**
title:

Objective: **1.2 Compare and contrast networking appliances, applications, and functions.**
2.1 Explain characteristics of routing technologies.



Episode 7.06

Episode **SOHO vs. Enterprise**
title:

Objective:

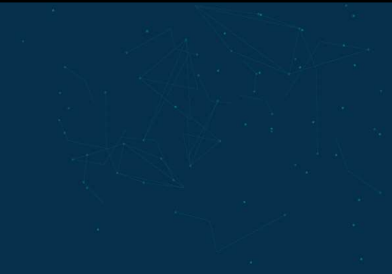
L3s

SOHO router

Enterprise router

100X bandwidth

IOS interface





Episode 7.07

Episode **Static Routes**

title: 1.7 Given a scenario, use appropriate IPv4 network addressing.

2.1 Explain characteristics of routing technologies.

Objective: 5.3 Given a scenario, troubleshoot common issues with network services

5.5 Given a scenario, use the appropriate tool or protocol to solve networking issues

L3s

Routing tables

Loopback

Multicast is a class D IP address

netstat -r = routeprint

Private "intranet" route



Episode 7.08

Episode **Dynamic Routing**
title:

Objective: **2.1 Explain characteristics of routing technologies.**
2.2 Given a scenario, configure switching technologies and features

L3s

Dynamic Routing

Convergence is where all router tables reflect all routes

Hop Count

Maximum transmission unit (MTU)

Bandwidth

Cost

Latency

L3s

Distance Vector and Link State

Distance vector uses hop count

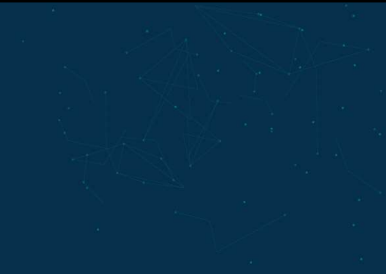
Link state uses advertising

Dynamic routing protocols are either IGP or EGP

MTU

Border Gateway Protocol (BGP)

MTU



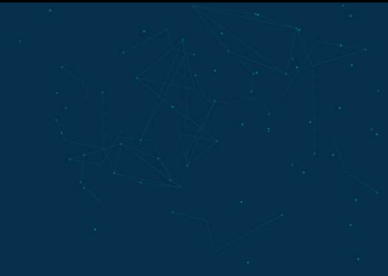
Episode 7.09

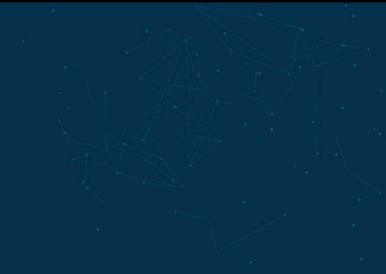
Episode **Open Shortest Path First (OSPF)**
title:

Objective: **2.1 Explain characteristics of routing technologies.**

L3s

Area ID





Episode 7.10

Episode **Border Gateway Protocol (BGP)**
title:

Objective: **2.1 Explain characteristics of routing technologies.**

L3s

Border Gateway Protocol (BGP)



Episode 7.11

Episode **Enhanced Interior Gateway**
title: **Routing Protocol (EIGRP)**

Objective: **2.1 Explain characteristics of routing technologies.**

Enhanced Interior Gateway Routing Protocol (EIGRP)

Improved version of IGRP

Distance vector protocol

- Determines the shortest path for packets to travel

**Shares and receives routing tables with
neighboring routers**

**Calculates routing metrics using
bandwidth and latency**

Neighbor Discovery/ Recovery

Helps routers learn other routers on their same path

Determines unavailable routers

Reliable Transport Protocol (RTP)

Like TCP

**Ensures sequential delivery of
multicast and unicast messages**

Diffusing Update Algorithm (DUAL)

**Manages and dynamically updates
routing table automatically**

**Calculates routing loops using feasible
paths and removes problem routes**

Protocol-Dependent Modules (PDMs)

Used for Layer 3 packets that are protocol-specific (like IP-EIGRP module)

Updates routing and topology tables based on neighboring routers

Used for protocols such as IPv6, IP, and AppleTalk

EIGRP Tables

**Neighbor
Table**



**Topology
Table**

- Contains information about neighboring routers
- Address, interface type, and HoldTime are recorded
- Acts as the interface to next hop
- Routes from neighboring routers
- Contains destination addresses and routing metrics of neighboring routers
- Can be passive or active

EIGRP Routes

Successor

- Best route based on metric values

Feasible successor

- Alternative or backup routes if successor is unavailable

EIGRP Packet Types

Hello packet

- Used to verify router availability

Update packet

- Unicast messages sent to newly-discovered neighbor routers

Query packet

- Multicast messages to indicate destination is in “Active” state
- Unicast message when sent as a reply to another query

EIGRP Packet Types

Reply packet

- Unicast responses to indicate neighbor won't be put into "Active" state due to existing feasible successors

Request packet

- Ask one or more neighboring routers for specific information

EIGRP Internal vs. External Routes

Internal route

- Within the same autonomous system (AS)

External route

- Supplied by a router outside the AS
- Can also be a static route



Episode 7.12

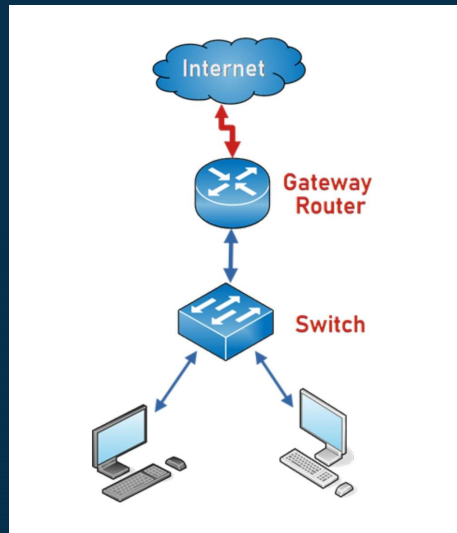
Episode **First Hop Redundancy Protocol**
title: **(FHRP)**

Objective: **2.1 Explain characteristics of routing technologies.**

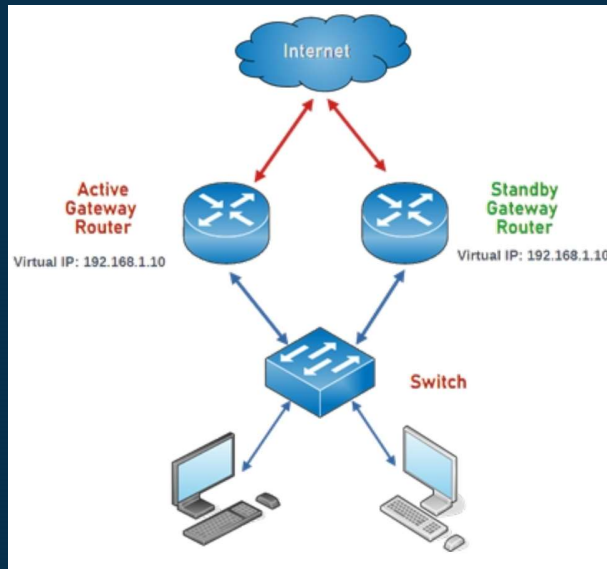
First Hop Redundancy Protocol (FHRP)

Provides failover redundant virtual gateway when primary gateway router fails

Common Network Configuration



FHRP Network Configuration



FHRP Options

Hot Standby Router Protocol (HSRP)

- Proprietary Cisco protocol
- Uses virtual IP address
- Each router in a group are assigned the same virtual IP, which become the default gateway IP

FHRP Options

Virtual Router Redundancy Protocol (VRRP)

- Vendor-neutral protocol
- Groups a cluster of physical routers to produce a new single virtual router
- Assigns the same virtual gateway IP address and MAC address on all physical routers in the VRRP group
- Preemption is enabled by default (unlike HSRP)
- Assigns two router states: master and backup

FHRP Options

Gateway Load Balancing Protocol (GLBP)

- Proprietary Cisco protocol
- Includes load balancing
- Selects and Active Virtual Gateway, the other routers become backups (assigned standby or listening state)
- Routers are configured with multicast IPv4 address of 224.0.0.102
 - Sends hello packets every 3 seconds on UDP port 3222